

BOROJOA AND TOCOYENA (RUBIACEAE) IN PANAMA

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The genus Borojoa (Tribe Gardenieae) has been treated recently by Dr. Julian Steyermark (Bol. Soc. Venez. Cienc. Nat. 26: 416-478. 1966). The genus has not been reported north of South America. Principally through the efforts of Dr. James Duke of Battelle Memorial Institute, Columbus, Ohio, three species have been collected recently in the Republic of Panama. One of these is a new species, one is sterile, and the third is the familiar Colombian B. patinoi Cuatrecasas. Despite the fact that Cuatrecasas (the author of the genus Borojoa) has provided an excellent description of B. patinoi, I have elected to describe the Panamanian collections, with the exception of the flowers (here male) as they are in bud only.

1. BOROJOA PATINOI Cuatrecasas, Rev. Acad. Colombia Cienc.  
7: 474. 1949.

Trees up to 7 m tall, the branchlets smooth, subplano-compressed, glabrous, the bark thin and peeling easily, the internodes here up to 6 cm apart, the uppermost pedicel scars often prominent. Leaves with the petioles up to 3.8 cm long, glabrous; lamina elliptic, cuneate at the apex, cuneate to truncate-obtuse at the base, up to 36 cm long, up to 17 cm wide, thin-coriaceous, presumably glabrous, the costa prominent above, prominent beneath, up to 1.8 mm wide, obviously porcate above distally, the principal veins ca 15, broadly arcuate, up to 3 cm apart, usually 1-1.5 cm apart, the tertiary veins pinnatifid, patulous, tending to persist and later often reflexed, connate below the middle to form an appressed cylinder, ovate-elliptic to ovate, up to 4 cm long, up to 1.2 cm wide, acute (or obtuse?) at the apex, stiffly chartaceous, with a slender median carina on the outside, venose, the veins ascending, crowded, prominent, the intervenal areas delicately patulous-reticulate. Flowers (here male) crowded into a terminal capitate cluster, ca 2.5 cm long, the corolla at first enclosed within the calycine cup. Fruit sessile, rotund, ca 7 cm in diameter, crowned by a persistent calyx, the fruit wall thick, smooth, glabrous, ca 1 cm thick, the seeds here ca 0.5 cm long, embedded in a pulp.

PANAMA: Darien: Finca Othon nr Yape, Duke 11820 (MO); Santa Fe, Duke & Bristan 310 (MO); 311 (MO); Rio Morti, Drill Site 7, ca 250 m elev, Duke 11181 (MO); between Rio Punusa & Rio Pucro, Duke 11637 (MO); without specific locality, Duke 8332 (MO).

Duke records that the tree is cultivated for its fruit; these take more than a year to ripen; the falling away of the terminal stipuloid bracts signal the maturation of the berry. The wood is described as soft. The mass of male flowers with the corolla tube still within the calyx has the appearance of a young Morinia fruit in Duke 8332. Common names recorded by Duke are "Borojo", "Borojo Hembra", "Borojo Macho", "Borojo del Monte" (Choco Indians), and "Buriyo" (Choco). Borojoa is closely related to Genipa and therefore should be of interest biochemically.

## 2. BOROJOA PANAMENSIS Dwyer, spec. nov.

Arbores parvae, ramulis subteretibus fere rimosis ultime subplano-compressis fortasse glabris, internodiis ad 9 cm distantibus, cicatricibus petiolorum subrotundis vel cordatis prominentibus, ca 0.4 cm diam. Folia petiolis ad 2 cm longis, in medio ad 0.2 cm latis, laevibus proximaliter turgidis; lamina elliptico-rotunda, apice lato-cuneata, brevi-acuminata, basi cuneata et subaequilaterali, ad 19 cm longa, ad 12.5 cm lata, rigido-chartacea, fortasse glabrescenti praeter costam minute diffuso-auro-pubescentem et praeter axillas venarum principalium saepe auro-barbellatas, costa supra prominula, subtus prominenti et porcata praecipue proximaliter, venibus lateralibus ca 10, supra prominulis, subtus subprominentibus ad prominentibus, ad 3 cm distantibus, plerumque ca 2 cm distantibus, venis tertiariis pinnatifimbriis; stipulae superiores persistentes ad medium connatae, tubo cylindrico, ad 1 cm longo, basi prominentia triangulari, ad 6 mm longa, ca 0.5 cm lata notato, aetate provento fisso reflexoque, partibus liberis obovato-rotundis ad ellipticis, acuminatis, ad 2 cm longis, ad 1 cm latis, plerumque supra medium latioribus, tenui-coriaceis, pallido-brunneis minute venosis, extus carina tenui media ornatis. Flores non visi. Fructus terminales, sessiles, solitarii, globoso-rotundi, ad 4.6 cm longi, ad 1.2 cm diam, ca 0.4 cm alto.

PANAMA: Coclé: Cerro Pilon nr. El Valle de Antón, ca 2700 ft elev, Duke & Dwyer 15014 (MO, holotype); Lallathin 5014 (MO). Panama: Cerro Jefe to Eneida, ca 2700 ft elev, Dwyer, Duke & Dressler 8243 (MO).

Borojoa panamensis is the first new species of the genus to be described north of South America. It is readily distinguished by its elliptic-rotund blades with few lateral veins; these are glabrous except for minute tufts of hairs in the majority of the axils of the secondary veins on the lower side. The common name is "Madrono".

## 3. BOROJOA SP.

Shrubs small, the branchlets drying tan, diffuse-pilulose.

Leaves with the petioles up to 3 cm long, 0.35 cm wide, puberulent; blades elliptic, cuneate and briefly acuminate at the apex, cuneate to vaguely obtuse and subequilateral at the base, up to 36 cm long, to 13 cm wide, thinly chartaceous, drying black above, moderately diffuse-golden-pilose beneath especially on the veins and the lateral nerves, the costa prominulous above, porcate proximally, prominent beneath, up to 1.8 mm wide, the secondary veins ca 10, widely arcuate, up to 2 cm apart, occasionally with 1-2 irregular and evanescent veins diverging between a pair of lateral veins; stipules not seen; bracts terminal, stipuloid (?), crowded, imbricate, the mass up to 4 cm long and wide, each bract elliptic, cuneate toward the apex but finally obtuse, up to 2.5 cm long, up to 1.5 cm wide, thin-coriaceous, drying black venose, medianally carinate on the outside, golden pilose, the hairs tending to persist only on the margins.

PANAMA: Darien: Cerro Pirre, Bristan 495 (MO).

Unfortunately the collection is sterile. The aggregation of bracts seems particularly noteworthy; these simulate in form and texture the stipules of known species of Borojoa but are not connate at the base, a fact which may be significant.

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In 1928 Standley described Posoqueria pittieri and later transferred this to Tocoyena Aubl. T. pittieri (Standley) Standley ranges from Costa Rica to Panama. Steyermark in his recent treatment of Tocoyena (Mem. N.Y. Bot. Garden 12: 192-197. 1965) considers the genus to be restricted to South America, presumably unaware of T. pittieri and T. obliquineria (Standley) Standley. Recently I have had the opportunity to examine some excellent material of T. pittieri collected in Panama. In view of Standley's incomplete description I have elected to give the following diagnosis and to consider briefly the genus Tocoyena whose center of distribution appears to be in northern Brazil. The genus extends south to Paraguay.

TOCOYENA PITTIERI (Standley) Standley, Contr. Arn. Arb. 5: 151. 1933.

Posoqueria pittieri Standley, Jour, Wash. Acad. Sci. 18: 167. 1928

Trees up to 10 m high, with the branchlets often nodose, the nodes usually 2-3 cm long, terete, smooth, glabrous, the pith septate. Leaves with the petioles to 3 cm long, ca 0.25 cm wide, glabrous; lamina elliptic, widely cuneate to subrotund at the apex, short-acuminate, the acumen to 1 cm long, ultimately obtuse, cuneate toward the base, often somewhat inequilateral, up to 32 cm long, to 17 cm wide, stiffly chartaceous, black-brown when dry, glabrous except minutely pubescent beneath in the axils of the principal veins, minutely papillate under

magnification, lightly marcescent above, the principal veins ca 10, arcuate, the tertiary veins slender, irregular and open-pinnatifid, plane; stipules not seen. Inflorescence cymose-paniculate, resembling a candelabra, to 13 cm long, ca 11.5 cm wide, the flowers numerous, erect, the bracts and bracteoles triangular-subulate, 0.5-1 mm long. Flowers yellow, the pedicels 1-3 mm long, glabrous; hypanthium oblong, truncate, to 4 mm long, glabrous, the calyx cup ca 1 mm long, scarcely swollen, with the teeth 5, widely triangular-subulate, to 0.5 mm long, glabrous; corolla tube erect, to 9.5 cm long, 2-3.8 mm wide, slender, thickly carnosous, occasionally dilated slightly basally, glabrous externally, glabrous within except white-villose at the base, the lobes 5, forming an ovate-rotund mass in the bud, golden-farinose on the outside, at anthesis ovate-elliptic or elliptic-rotund, to 1 cm long, ca 0.65 cm wide, glabrous; stamens 5, exerted at anthesis, the anthers sessile, elliptic, ca 6 mm long, ca 2 mm wide, attached at the apex of the throat; ovary with the wall (including the hypanthium) up to 1 mm thick, 2-locellate, the ovules flat, subrotund, ca 0.2 mm diam, the style ca 0.6 mm wide, the stigmas 2, ovate-lanceolate, crassate, ca 5 mm long, obviously wider than the style, smooth on the adaxial surface. Fruits sessile, solitary, subrotund, obtuse or rotund at the apex, 6-10 cm in diam, woody when dry, the wall thick, to 1.3 cm diam, black when dry, tan within, smooth externally except longitudinally costate, the ribs perhaps 10-15, well-spaced, slender or thick, prominent, not ridge-like, often in part evanescent along their length, the general surface often marked by well-spaced corky eruptions, the seeds flat, ovate-trapeziform, obtuse, to 2 cm long, to 1.3 cm wide, ca 0.5 cm thick, slimy to the touch, the pulp when dry blue-black.

PANAMA: Canal Zone: Barro Colorado Island, Croat 4636 (MO). Darien: La Boca de Pirre, Bristan 1246 (MO); Río Balsa nr Río Coasi, Kirkbride & Duke 1386 (MO); Río Balsa nr Cerro Campamento, S Cerro Pirre, cloud forest, Duke 15599 (MO).

Several additional collections of Tocoyena pittieri have been made on Barro Colorado Island; in fact this has been the only collection site in Panama. Bristan records that the wood is hard; the twigs have a diaphragmed pith which resembles that of our black walnut Juglans nigra L. The corolla is an attractive lemon yellow; on falling from the tree it turns a drab brown (fide Croat; Kirkbride). T. pittieri probably has as large a fruit as is found in any Tocoyena, although judging from the original descriptions, only about one third of the species have been described from fruit. The fruit may reach the size of a fist and is marked by distinct although irregular and often incomplete ribs varying considerably in diameter. The fruit wall is lined with a glossy, tan, thin, and hard coat, up to 0.2 mm thick. Kirkbride & Duke note that the fresh pulp is brownish-black; the dried pulp is deep purple, resembling the

dried pulp of Genipa, a relative of Tocoyena. Genipa yields the well-known cyclopentanoid monoterpenes genipin and genipic acid (cf. Tallen in Tetrahedron 20: 178-187. 1964; also several papers by Djerassi et al in Journ. Organic Chem., beginning with vol. 23: 2174-2177. 1960.).

Tocoyena ranges from Mexico to Paraguay. T. cubensis (Griseb.) Britton a West Indian species, perhaps would be better placed in Casasia Rich.

In Tocoyena the principal characters separating the species are: the relative size of the leaves, the number of lateral veins of the lamina, the presence or absence of hairs on most parts of the plant, especially on the leaves, the hypanthium, and the inner surface of the corolla lobes; the length of the calycine teeth, the length of the corolla tube; the size and ribbing of the fruit.

The Mexican T. tabascensis Standley is probably not a Tocoyena; the inflorescence has the flowers disposed in threes and the corolla has only 4 lobes. In T. obliquinervia Standley the flowers are much smaller than in T. pittieri and the calycine lobes are not acute but obtuse. Among the South American species T. amazonica Standley, T. brasiliensis Mart., T. brevifolia Steyermark, T. hirsuta Moric ex DC, T. mollis Krause, T. sellonana (C. & S.) Schuman have much smaller leaves, measuring up to about 8 cm in width. The leaves of the Peruvian T. hispidula Standley are hispidulous. T. longiflora Aublet, the type species has glabrous foliage but has calycine squamellae and elongate calycine lobes. T. orinocensis Steyermark from Venezuela whose fruits are longitudinally ribbed is probably closely related to T. pittieri, but its corolla lobes and anthers are much larger. The Peruvian T. williamsii Standley is reported as having 6 corolla lobes while T. sprucei Standley has much smaller fruit. T. foetida P. & E., of Brazil and Colombia has much longer floral tubes as in the Venezuelan T. guianensis Steyermark, and a tomentose hypanthium as in T. stipulosa K. Schum., and presumably smaller fruit. T. cuatrecasii Steyermark from Colombia, T. hirsuta from Brazil, T. neglecta Brown, T. surinamensis Brem. from Dutch Guiana, and T. tomentosa Mor. (herbarium name?) from Brazil all differ from T. pittieri in having the leaves very pubescent. Noteworthy is the fact that the corolla lobes of T. costanensis Steyermark from Venezuela and T. cuatrecasii are pubescent within, unlike the lobes of T. surinamensis and T. pittieri. The Venezuelan T. pendulina Spruce ex Standley differs from all Tocoyena (except T. sprucei) in having the leaves widely rounded at the apex; the lamina is up to 8 cm wide with the lateral veins reduced to about 6; the corolla tube is very short, measuring up to 4.5 cm in length.